statistical instruments for industry

OPERATING AND SERVICE MANUAL

MODEL 603A, 624A SERIES

NOISE GENERATOR

MP MASTER
MA30373

ELGENCO INCORPORATED
1550 EUCLID STREET • SANTA MONICA, CALIFORNIA 90404 • (213) 451-1635

statistical instruments for industry

OPERATING AND SERVICE MANUAL

MODEL 603A, 624A SERIES NOISE GENERATOR

Model 603A
Serial Numbers Prefixed 029-
044-
046-
062-
078-
079-

Model 624A Series
Serial Numbers Prefixed 050-
063-
080-

ELGENCO INCORPORATED
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IMPORTANT

Immediately upon receipt the instrument should be thoroughly inspected for possible damage in shipment. If the instrument is damaged in any way, a claim should be filed with the carrier. All material in the container should be checked against the enclosed packing list. The seller will not be responsible for shortages against the packing list unless notified immediately.

WARRANTY

Elgenco, Incorporated warrants each instrument manufactured by us, and sold by us or our authorized agents, to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the factory for that purpose and to making good at the factory any part or parts thereof except electron tubes, fuses, electro-mechanical choppers and batteries. This warranty is effective for one year after delivery to the original purchaser: when the instrument is returned, transportation charges prepaid by the original purchaser; and when upon our examination it is disclosed to our satisfaction to be defective. If the fault has been caused by misuse or abnormal conditions of operations, repairs will be billed at cost. In this case, an estimate will be submitted before the work is started.

RESERVED RIGHTS

Elgenco, Incorporated reserves the right to discontinue instruments without notice, to make changes in design, and to make additions or improvements at any time without incurring any obligation to make such modifications to instruments previously manufactured.

It is the policy of Elgenco, Incorporated to supply equipment patterned as closely as possible to the particular requirements of the individual customer. As much as possible this is accomplished, without incurring the costs of custom design, by substituting new components, modifying old components, etc. As a result, this instruction manual, which has basically been written to cover standard equipment, may not entirely concur in its content with the equipment supplied. It is felt, however, that a technically qualified person will find the manual a fully adequate guide in understanding, operating, and maintaining the equipment actually supplied.

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SECTION 1

INTRODUCTION

This manual is intended for use in the operation and maintenance of the Elgenco, Inc. Model 603A and the Elgenco, Inc. Model 624A Series Gaussian Noise Generators.

This Noise Generator is a self-contained precision device designed for use where a reliable source of random noise is required. This noise generator provides an output having a Gaussian (normal) distribution with negligible mean (dc unbalance).

The Model 603A provides three frequency ranges, each from 5 hertz to an upper frequency as specified by the front panel RANGE switch. Within each frequency range the power spectrum is uniform.

A Noise Generator in the 624A Series, is a fixed frequency band Noise Generator. The frequency band and power spectrum uniformity are as specified by the unit decale.

Each instrument has been thoroughly checked and tested before shipment from the factory and is ready for use when received. Upon receipt of the instrument, inspect carefully for any damage which may have been incurred in transit.

Each Noise Generator is identified by a five-digit serial number with a three-digit prefix (000-00000). The prefixes that appear on the title page of this manual indicate the instruments to which this manual directly applies. A supplement may be included with this manual to indicate the necessary changes to be made in the manual to make it apply directly to units which carry a different serial number prefix.

SECTION 2

SPECIFICATIONS

SPECTRAL CHARACTERISTICS
Model 603A

Range	Spectrum Uniformity		Approx. Spectral Density, Mv/$\sqrt{Hz}$ at 1-Volt RMS
20 kHz	10 Hz to 20 kHz	±1.0db	5
500 kHz	10 Hz to 500 kHz	±1.0db	1.2
5 mHz	10 Hz to 500 kHz	±1.0db	0.4
	10 Hz to 5 mHz		
	Prefixes 029, 044, 046	±3.5db	
	062, 068, 079	±3.0db	

The output is within approximately 3db at 5 Hz on all bands.

Model 624A Series

The five digit suffix - "ABCDE" of each 624A Noise Generator describes the unit spectral uniformity, and frequency range of spectral uniformity. The complete Model 624A Model number is given on the description plate mounted on the rear panel. The suffix code is:

A, spectral uniformity as: 5 for ±0.5db
1 for ±1.0db
2 for ±2.0db
3 for ±3.0db

B, first significant figure of low frequency end of specified band.

C, zeros to add to significant figure B.

D, first significant figure of high frequency end of specified band.

E, zeros to add to significant figure D.

EXAMPLES:

624A-32115; within ±3.0db from 20 hertz to 100 kilohertz.
624A-51155; within ±0.5db from 10 hertz to 500 kilohertz.

OUTPUT LEVEL

(Minimum value of maximum open circuit output.)
3.0 Volts rms all ranges

A dynamic range of 3.5 to 1, peak-to-rms value, is provided at 3 volts rms open circuit output; increases at lower output amplitude control settings.

OUTPUT STEP ATTENUATOR

Five positions: X1.0, X0.1, X.01, X.001, and X.0001; calibrated to work into open circuit.

Accuracy	±3% to 100 kHz ±5% to 5 mHz
Output Impedance	200 ohms ±5% at X1.0, 200 ohms ±1% other settings

AMPLITUDE PROBABILITY DISTRIBUTION

Symmetrical Gaussian distribution on all ranges.

OUTPUT METER

Rectifier type meter circuit reads proportional to average value, calibrated to read rms value of Gaussian Noise; 0-5 volts rms scale.

OUTPUT IMPEDANCE

(on direct output)
200 ohms ±5%

MAXIMUM LOAD

(on direct output)
700 ohms

POWER REQUIREMENTS

115/230 volts ±10/20 volts, 50 to 1000 Hz, approximately 5 watts.
The Model 603A or 624A with battery option provides 10 hours of operation with fully charged battery. Battery is recharged by operating the unit on the AC line, with approximately 30 hours required for complete recharge.

DIMENSIONS

5-1/4" high x 8-5/8" wide x 11" deep.

WEIGHT

Net without battery option 9.5 lbs.
Net with battery option 12 lbs.
Shipping without battery approximately 12 lbs.

RACK MOUNT

Units may be supplied with full rack width mounting option. The unit uses 5-1/4-inch in a 19-inch wide rack mount. Units with full rack width option are identical to cabinet version with the exception of wider front, rear, top and bottom panels, and addition of mounting ears.

A rack mounting adapter kit is available for rack mounting one unit. Also available is a kit for rack mounting two units side by side. Units use 5-1/4" x 19" of rack panel space with the adapter kits.

SECTION 3

CONTROLS & INDICATORS

FRONT PANEL

AMPLITUDE potentiometer and meter. The potentiometer is used to vary the RMS value of the output. The meter indicates the RMS value prior to the attenuation by the ATTENUATOR switch.

ATTENUATOR - five position switch. This switch allows attenuation of output. Steps are X1.0, X0.1, X.01, X.001 and X.0001.

RANGE - Model 603A only - three-position switch. This switch allows selection of frequency range at output.

LINE - switch and light. The switch applies line power to the unit and to the light. In the case of the battery operated instrument, the switch also applies DC power to the unit.

OUTPUT - banana connector. Provides unit output connection.

REAR PANEL

115/230 - switch. Allows operation on either of two line voltage ranges.

AC - connector and slo-blo-fuse. Connector is provided for 115/230 VAC input power. The fuse is on the ac line.

BNCR-OPTION - units employing this option have an output BNC mounted on the rear panel.

PRINTED CIRCUIT BOARDS

AMPLIFIER ASSEMBLY

Two potentiometers (one on encapsulated assembly, A1A1) allow factory adjustment of the noise source characteristics and output level.

METER ASSEMBLY

One potentiometer allows adjustment of the meter rectifier circuit.

POWER SUPPLY ASSEMBLY

A potentiometer allows adjustment of the -30 volt power supply.

SECTION 4

INSTALLATION & OPERATION

INSTALLATION

Place the switch on the rear panel to the proper position (115v or 230v) and check for installation of the proper fuse. Connect the power cord to the power source and place the LINE switch on its ON position. The LINE light should light immediately.

NOTE: The LINE light does not operate when battery power is used.

Within a few seconds the meter should provide an upscale reading. Allow a few minutes settling time.

For each range provided, adjust the AMPLITUDE potentiometer to give a 2.0-volt RMS reading on the meter.

OPERATION

To attenuate the noise generator output, the AMPLITUDE potentiometer may be used to provide continuous control between 0 volts and maximum output. For output levels below 0.25 volt, the ATTENUATOR is provided to allow attenuation in 20 db increments.

The OUTPUT meter indicates the RMS voltage applied to the output; there the actual output level is the voltage indicated on the meter multiplied by the ATTENUATOR setting, neglecting loading considerations.

In the X1 ATTENUATOR setting the attenuator is disconnected and the generator output is applied directly to the load.

The other four ATTENUATOR positions are calibrated for infinite load resistance and zero capacitive loading. For high values of load resistance, or where very high accuracy is required, the load voltage (E_L) at a resistive load (R in ohms) may be calculated from the indicated voltage (E_I) as follows:

$$E_L = E_I \times \frac{R}{R + 200} \times (\text{Attenuator setting})$$

NOTE: Use of the 5MC range requires proper attention to the effect of shunt capacity at the load.

BATTERY OPTION

NOTE: The battery will provide power to the unit whenever LINE switch is on and no ac power is applied to the unit. LINE light will be off under these conditions.

The battery operated instrument will provide approximately 10 hours of operation on the fully charged battery. The battery is recharged by operating the instrument on ac power, with approximately 30 hours required for a full recharge.

CAUTION

Do not charge the battery for extended periods of time (more than approximately four hours) at ambient temperatures above 50^{o} or $122^{o}F$.

SECTION 5

THEORY OF OPERATION

GENERAL

A block diagram of the Model 603A Noise Generator is given in figure 5-1.

The block diagram for the Model 624A Series Noise Generator is the same as given in figure 5-1 except that switchable resistors and capacisors are replaced by fixed components mounted on the amplifier printed circuit board. The switch is not used.

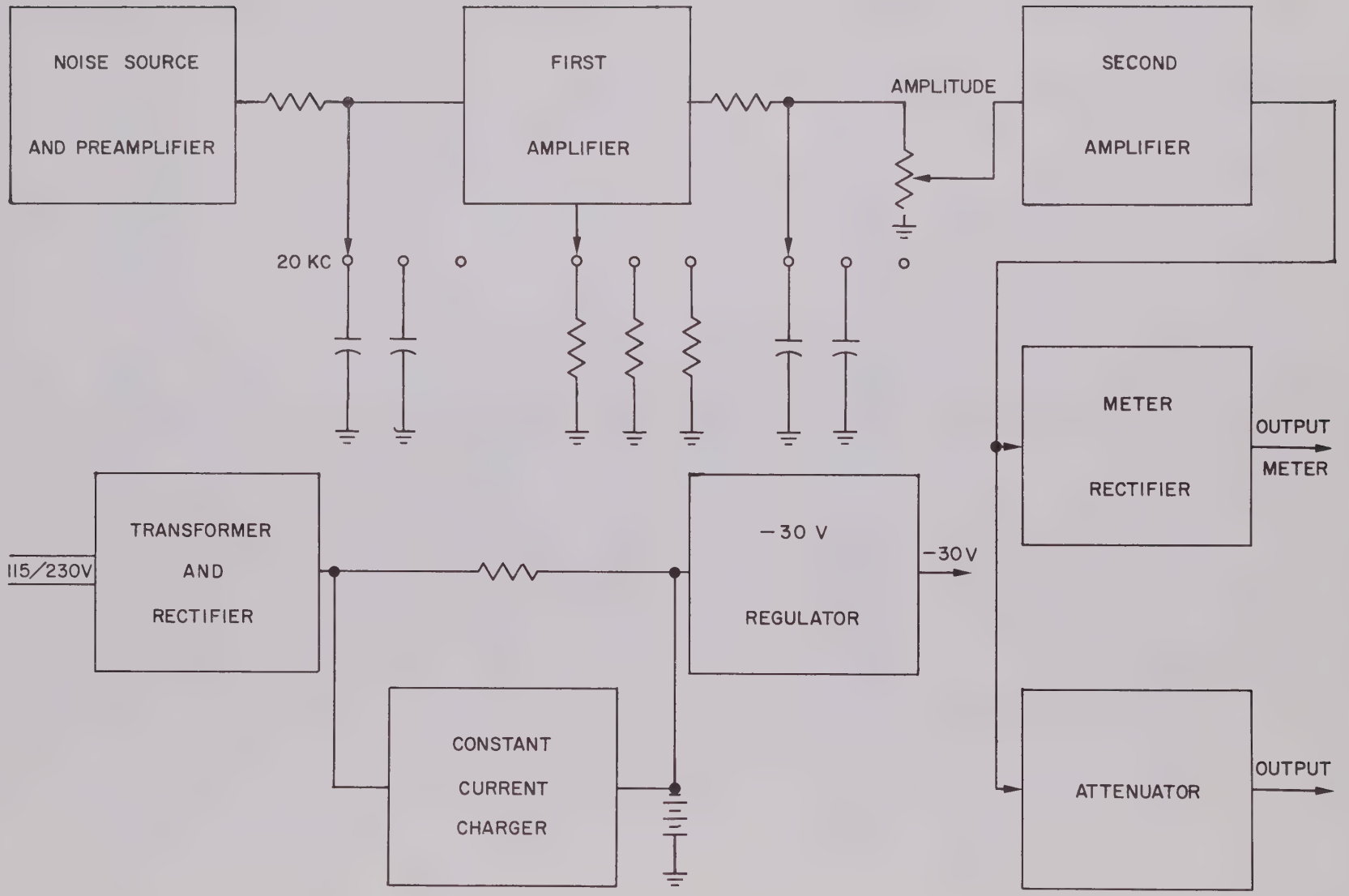
The Noise Generator employs a solid state device as a noise source. The output of this noise source is amplified by a special, low-noise feedback preamplifier. The noise source and preamplifier are encapsulated.

The noise is then passed through a single pole, low pass, RC filter; switchable in the Model 603A. The resulting signal is further amplified by a feedback amplifier, first amplifier. (The appropriate gain for each frequency range in the Model 603A is selected by the range switch.) The resulting noise voltage is then passed through another single pole low pass RC filter and through the AMPLITUDE control to the second, output, amplifier. (This RC filter is also switchable in the Model 603A.) The output of this amplifier is fed to the output meter and five position output attenuator. The output of the attenuator is brought to the front panel. The output meter is an average reading voltmeter calibrated to read the rms value of a Gaussian distributed voltage. The required dc power is supplied by the regulated power supply that uses a zener reference diode.

Circuit designations are as given on the schematic, Section 7.

A1A1 NOISE SOURCE AND PREAMPLIFIER

This unit is encapsulated to achieve high component density and reliable characteristics. A potentiometer shaft on the unit allows factory adjustment of the noise source for optimum characteristics. Another potentiometer, mounted on the amplifier assembly printed circuit board, allows


NOISE SOURCE
AND PREAMPLIFIER
FIRST
AMPLIFIER
AMPLITUDE
SECOND
AMPLIFIER
20 KC
METER
RECTIFIER
OUTPUT
METER
115/230V
TRANSFORMER
AND
RECTIFIER
−30 V
REGULATOR
−30V
CONSTANT
CURRENT
CHARGER
ATTENUATOR
OUTPUT

factory adjustment of the preamplifier gain. The high gain preamplifier uses negative feedback supplied by A1R3, A1R4, and A1R5 to achieve stability. A1R1-A1C1 and A1R2-A1C2 function as decoupling networks. A1R6 and the capacitors mounted at terminals 4 and 5 of RANGE switch A1S1, (A1C4 in 624A units) comprise the first filter section.

FIRST AMPLIFIER

Transistors A1Q1 and A1Q2 function as a feedback amplifier pair. Negative feedback is accomplished through the action of A1R12 and the resistor A1R13, A1R14, A1R15, selected by the RANGE switch. In the Model 624A A1R13 provides required feedback. The gain is approximately 750, 175, and 75 for 20 KC, 500 KC and 5 MC respectively. These gain levels, in conjunction with the gain level provided by A1R4 setting, allow for the proper unit rms output levels.

A high degree of dc stability is maintained through the action of emitter resistors A1R10, A1R11, and the overall feedback action. The output of this amplifier is applied through coupling capacitor A1C8 to the second RC filter section, A1R16 and associated capacitors, and then to the front panel AMPLITUDE CONTROL.

SECOND AMPLIFIER

Transistors A1Q3 and A1Q4 and associated circuitry comprise a feedback amplifier. Within the passband this amplifier provides a gain of ten, fixed by the feedback operation of A1R20 and A1R21. Series resistor A1R24 raises the output impedance (of this stage) to approximately 200 ohms. This is the output impedance when the ATTENUATOR is in the X1 position.

METER

The meter rectifier circuit is arranged in a bridge-type configuration with a diode, A2CR1, or A2CR2, and a capacitor, A2C2 or A2C3, in each branch and a dc microammeter connected across the branch midpoints. The current through the meter is proportional to the average value of the input voltage. The meter, through the use of A2R2 and A2C1, is factory calibrated to indicate the rms value of the noise generator output.

POWER SUPPLY

The power supply utilizes a standard series regulator circuit. AC line voltage is stepped down through transformer, T1; full wave rectified, A3CR1 and A3CR2; filtered, A3R11 and A3C1; and applied to the series regulating transistor A3Q5. Two differential amplifier stages regulate the operation of A3Q5. A change in output voltage is sensed by A3Q1-A3Q4.

The amplified push-pull error drives A3Q2-A3Q3. The single ended output from A3Q3 controls series regulator A3Q5. A3R2 is adjusted to provide -30V DC at the output.

The Noise Generator may be ordered with a rechargeable nickel-cadmium battery, or this feature may be added at any later time. BT1 supplies -36V DC to A3Q5 through A4CR4 whenever LINE switch is turned ON with no AC power applied to J1. When AC power is applied to J1 (and LINE switch is ON), A4CR4 is back baised, and the battery is recharged by a constant current of approximately 20 ma through A4CR5.

A fully charged battery will provide approximately 10 hours operation. Complete recharge requires approximately 30 hours.

CAUTION

Do not charge the battery for extended periods of time (more than approximately four hours) at ambient temperatures above 50 degrees C or 122 degrees F.

SECTION 6

MAINTENANCE

6.1 GENERAL

The maintenance data provided in this section assumes that maintenance personnel are familiar with the operating procedures and theory given in sections 4 and 5.

The Noise Generator is designed for long component life. The output stage has been designed to protect circuit elements against possible OUTPUT terminal short circuiting. (The collector, case, of A1Q4 is not short circuit proof.) Transistors, being inherently long life devices should not require replacement. If it becomes apparent, through systematic trouble shooting, that replacement is necessary, care should be taken not to damage the associated printed circuit board. Transistors can be damaged by excessive heat.

If it is determined that a component requires replacement, a component of the same quality, or of better quality, must be used in the replacement process.

When servicing the printed circuit boards; do not apply excessive heat to the conductor or component being soldered; clean all holes before inserting new components; remove components with a straight upward motion; and solder from the conductor side.

As a guide in trouble shooting, typical voltages to circuit ground, are included in table 6-1.

CAUTION: The collectors of transistors A1Q1, A1Q2, A1Q3, A1Q4, A3Q5 and A4Q1 are physically connected to the transistor case.

6.2 CHASSIS DISASSEMBLY

The Noise Generator is opened for servicing by removing screws securing either of the two side covers, removing side cover, sliding out the top and bottom covers, and sliding out the remaining side cover and attached rods.

A1 AMPLIFIER ASSEMBLY is exposed by removing the shield on the left side of the unit.

ATTENUATOR ASSEMBLY is exposed by removing the shield on the left side of the unit.

After removing either of the side shields, reinstall the flat head screws to secure the interior assemblies to the front and rear panels before applying power to the unit.

CAUTION: When reassembling the instrument do not tighten the 8 flat head screws (4 each in top and bottom). First assemble and tighten the two side covers in place on the instrument without the painted top and bottom covers. In this manner the internal sheet metal fixes the proper spacing between front and rear panels. One of the side covers may then be removed, top and bottom covers slid into place and side replaced.

6.3 TEST EQUIPMENT

The following test equipment, or equipment comparable in scope, is required for complete testing of the Noise Generator.

(1) 15 mHz oscilloscope. (Hewlett-Packard 180, Tektronix 531A)

(2) True rms voltmeter with a crest to rms factor of at least 8 to 1 and 10 mHz bandwidth. (Hewlett-Packard 3400A).

(3) Spectrum analysis equipment to cover 10 Hz to 5 mHz.
(Quan-Tech Noise Analyzer Model 304A. 1Hz to 5 kHz, 10 Hz bandwidth; Hewlett-Packard 310A, 200, 1000, or 3000 hertz bandwidth, 1 kHz to 1.5 mHz, 10 microvolt sensitivity, modified to provide 20-second meter time constant.

Rohde & Schwarz Type USVH BN1521 Selective Microvoltmeter (5kHz bandwidth, 1.5 to 5 mHz.)

(4) DC vacuum tube voltmeter.

6.4 POWER SUPPLY ADJUSTMENT

The -30 volt power supply output is adjusted to -30 volts ±0.25 volts to insure proper operation of the noise generator.

After replacement of any component in the power supply, check the following:

(1) Output is -30V ±0.25v (adjust A3R2).

(2) Power supply regulates within 0.15 volt over entire range of input AC voltage.

6.5 METER CIRCUIT

If the need arises to test the metering circuit, it should be tested with the printed circuit board mounted on the meter. Any adjustment of A2R2 must

be made with the meter and circuit board properly mounted on the front panel.

NOTE: The meter circuit is calibrated to indicate the rms value of Gaussian Noise. Gaussian noise will provide inaccurate readings when applied to average or peak responding voltmeters calibrated to indicate the rms value of sinusoidal waveforms; therefore, only a true rms voltmeter should be used as a calibrator.

For the Model 603A, adjust A2R2 at 3V on the 500 KC range. Typically the meter reads 0.2 volts high on the 20 KC range and 0.2 volts low on the 5 MC range.

6.6 A1 AMPLIFIER ASSEMBLY TROUBLESHOOTING

The adjustment on encapsulated assembly A1A1 should not be disturbed under any circumstances. The variable resistor A1R4 on the circuit board need only be adjusted in case of the replacement of A1A1.

Adjustment of A1R4 should be made to provide the proper output voltage. A1R4 is adjusted for 3.3 volts RMS on the 20 KC range. The values of the A1R14 and A1R15 may have to be slightly adjusted to provide at least 3 volts on the 500 KC and 5 MC ranges. NOTE: The output value on the 5 MC range is about 0.2 volts low with the unit uncased.

Noise generator operation may be tested by observing:

(1) That the proper voltage output is obtained at each setting of the RANGE switch.

(2) That the spectral density is uniform within specified limits within each band.

When equipment is used to determine spectral density, care should be exercised to insure that length of measurement is consistent with bandwidth of measurement (i.e. several minutes measurement time is required at the lower frequencies).

Malfunctions may be isolated according to whether they affect all bands or one band. In case all bands are affected, a check of the DC levels will usually indicate the problem area. One bad band only indicates a faulty switch or filter component. It should be noted that grossly in-error power spectral density uniformities will also be observed as improper output levels.

6.7 SPECTRAL UNIFORMITY TEST MODEL 603A

6.7.1 Set the Noise Generator LINE switch to ON position, the AMPLITUDE control to maximum clockwise position, the ATTENUATOR to X1,

and the RANGE to 20 KC. Allow the Noise Generator to warm up and stabilize for 3 minutes. Insure that the ac line voltage is 115VAC.

6.7.2 The total maximum allowable decibel deviation between any two values read from the noise analyzer, the wave analyzer, and the selective microvoltmeter for a given range setting on Noise Generator is as follows:

RANGE	FREQUENCY	TOTAL MAXIMUM ALLOWABLE DECIBEL DEVIATION
20 KC	All frequencies	2.0
500 KC	All Frequencies	2.0
5 MC	10 Hz to 500 kHz	2.0
5 MC	10 Hz to 5 mHz	7.0 (prefix 029; 044; 046-)
		6.0 (prefix 062; 078; 079-)

6.7.2.1 EXAMPLE: On the 20 KC range, for adjusted reading from reference zero (0):

a) -1.4 decibels, +0.5 decibels is acceptable
(total deviation is 1.9 decibels)

b) +1.3 decibels, -0.9 decibels is not acceptable
(total deviation is 2.2 decibels)

6.7.3 The values of the readings obtained from the noise analyzer, the wave analyzer, and the selective microvoltmeter are relative rather than exact. It is required that the readings be adjusted between the instruments before evaluating decibel deviation. To accomplish this adjustment proceed as follows:

6.7.3.1 Set the 1 kHz noise analyzer reading equal to "zero". Adjust the other noise analyzer readings to conform with this value.

6.7.3.2 Set the 5 kHz wave analyzer reading equal to the adjusted 5 kHz noise analyzer reading. Adjust the other wave analyzer readings to conform with the adjusted 5 kHz wave analyzer reading.

6.7.3.3 Set the 1.5 mHz selective microvoltmeter reading equal to the adjusted 1.5 mHz wave analyzer reading. Adjust the other selective microvoltmeter readings to conform with the adjusted 1.5 mHz selective microvoltmeter reading.

6.7.3.4 EXAMPLE: 5 MC RANGE

	(ACTUAL READINGS) db			(ADJUSTED READINGS) db		
FREQ.	NOISE ANA-LYZER	WAVE ANA-LYZER	SELEC-TIVE MICRO VOLT METER	NOISE ANA-LYZER	WAVE ANA-LYZER	SELEC-TIVE MICRO-VOLT-METER
13 Hz	-3.66			-1.2		
20 Hz	-3.36			-0.9		
60 Hz	-3.24			-0.8		
120 Hz	1.96			+0.5		
500 Hz	-2.68			-0.2		
1 kHz	-2.44			0		
5 kHz	-2.62	-2.0		-0.2	-0.2	
10 kHz		-2.0			-0.2	
20 kHz		-2.0			-0.2	
100 kHz		-2.0			-0.2	
200 kHz		-2.1			-0.3	
500 kHz		-2.0			-0.2	
700 kHz		-1.8			0	
1 mHz		-1.9			-0.1	
1.5 mHz		-3.1	-2.8		-1.3	-1.3
3 mHz			-3.2			-1.7
5 mHz			-6.0			-4.5

Total Deviation 10 Hz to 500 kHz is 1.7 db

Total Deviation 10 Hz to 5 mHz is 5.0 db

6.7.4 Connect the noise analyzer to Noise Generator output.

6.7.4.1 Set the noise analyzer in the 10-second time constant mode with a 10-hertz band width. Use the upper scale with a full-scale value of 1, and

1.00 as "zero decibels". Provide a calibration chart for other values. The scale reading between .60 and 1.00 will indicate approximately 1.0 decibel per .1 scale reading. Wait approximately 30 seconds between readings, and note that the readings should be the average between the high and low limits of the meter needle bounce (typically will be 0.1 to 0.14 on the meter scale).

6.7.4.2 Record in decibels the spectral content at 13, 20, 60, 120, 500, 1000, and 5000 hertz.

6.7.4.3 Adjust the Noise Generator RANGE to 500 KC and repeat the procedure in 6.7.4.2.

6.7.4.4 Adjust the Noise Generator RANGE to 5 MC and repeat the procedure in 6.7.4.2.

6.7.5 Disconnect the noise analyzer from the Noise Generator. Connect the wave analyzer to Noise Generator OUTPUT.

6.7.5.1 Modify the wave analyzer by placing a 1500 microfarad capacitor across the meter terminals. Set the wave analyzer in the relative mode with the MAXIMUM INPUT step control set to 10. Use a 1 kHz bandwidth with a range of from 5 kHz to 1.5 mHz. Readings should be the average between the high and low limits of the meter needle bounce (approximately 0.4 decibels).

6.7.5.2 Adjust the Noise Generator RANGE to 20 KC and record in decibels the spectral content at 5K, 10K, and 20K hertz.

6.7.5.3 Adjust the Noise Generator RANGE to 500 KC and record in decibels the spectral content at 5K, 10K, 20K, 100K, and 200K, 500 K hertz.

6.7.5.4 Adjust the Noise Generator RANGE to 5 MC and record in decibels the spectral content at 5K, 10K, 20K, 100K, 200K, 500K, 700K, 1000K and 1500K hertz.

6.7.6 Disconnect the wave analyzer from the Noise Generator. Connect the selective microvoltmeter to Noise Generator OUTPUT.

6.7.7.1 Use the selective microvoltmeter 5 kHz bandwidth, with a range of from 1.5 mHz to 5 mHz. Readings should be the average between the high and low limits of the meter needle bounce (approximately 0.4 decibels).

6.7.6.2 With the Noise Generator RANGE still set at 5 MC, record in decibels the spectral content at 1.5M, 3M, and 5M hertz.

6.8 SPECTRAL UNIFORMITY TEST MODEL 624A

6.8.1 Follow the procedure given in 6.7.

6.8.2 Read the frequencies given in 6.7.3.4 that are within the 624A Noise Generator, specified band.

6.8.3 Verify that the maximum decibel deviation for all readings is within the specified limits; twice the Noise Generator specified spectral uniformity.

6.9 ATTENUATOR TEST

6.9.1 Set the Noise Generator power to ON position, the AMPLITUDE control to X1, and RANGE to 20 KC. Allow the Noise Generator to warm up and stabilize for 3 minutes.

6.9.2.1 Connect the Noise Generator to a true rms voltmeter.

6.9.2.2 Set the AMPLITUDE control so that the Noise Generator meter reads 2.8 volts.

6.9.2.3 Read and record the voltmeter reading.

6.9.2.4 Set the Noise Generator ATTENUATOR to X0.1. Adjust the AMPLITUDE control for 2.8 volts on the Noise Generator meter.

6.9.2.5 Verify that the attenuation as observed by the true rms voltmeter is within the specified accuracy.

6.9.2.6 Repeat steps 6.9.2.4 and 6.9.2.5 for Noise Generator ATTENUATOR settings X.01, X.001 and X.0001. Verify the attenuation as observed by the true rms voltmeter is within specified accuracy.

6.9.3 Repeat the procedure given in 6.9.2 with the Noise Generator RANGE to the 5 MC position.

6.9.4 CAUTIONS

6.9.4.1 Avoid ground loops in testing.

6.9.4.2 Provide proper shielding.

6.9.4.3 As much as 10 pfd capacitive loading at the output terminals, when testing with the RANGE to 5 MC and moving the ATTENUATOR from X1 to X0.1 will cause incorrect results.

TABLE 6-1 TYPICAL VOLTAGE TO GROUND

	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	E	B	C
A1A1	18.5	11.9	1.6	0.2	0			
A1Q1						8.3	8.9	11.8
A1Q2						12.4	11.8	4.3
A1Q3						1.7	2.4	29.5
A1Q4						30.0	29.5	15.6
A3Q1						5.1	5.3	15.8
A3Q2						15.7	15.8	30.0
A3Q3						15.7	15.8	30.2
A3Q4						5.1	5.2	15.8
A3Q5						30.0	30.2	38.7

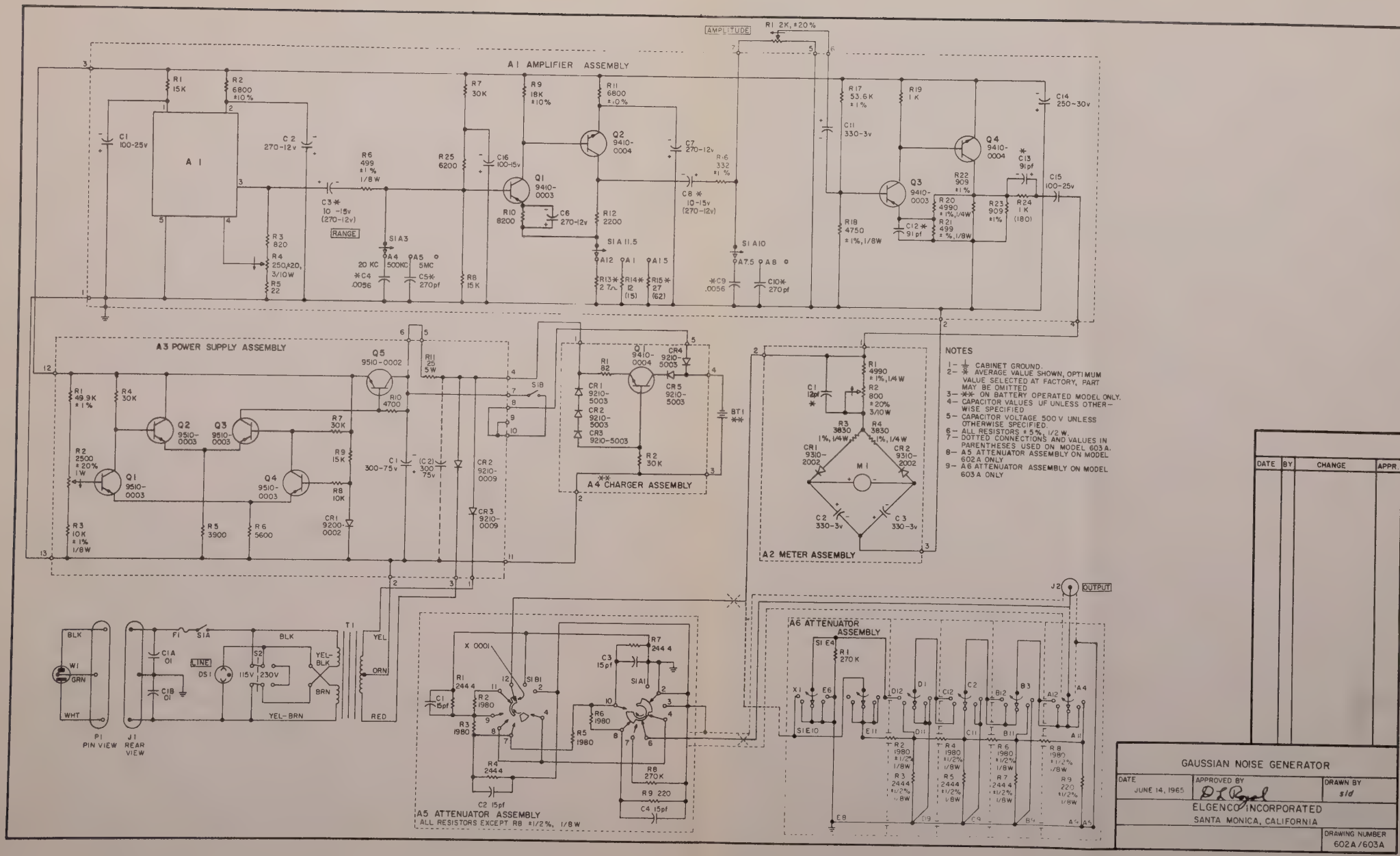
All voltages are negative and measured to ground with an HP 412A VTVM.

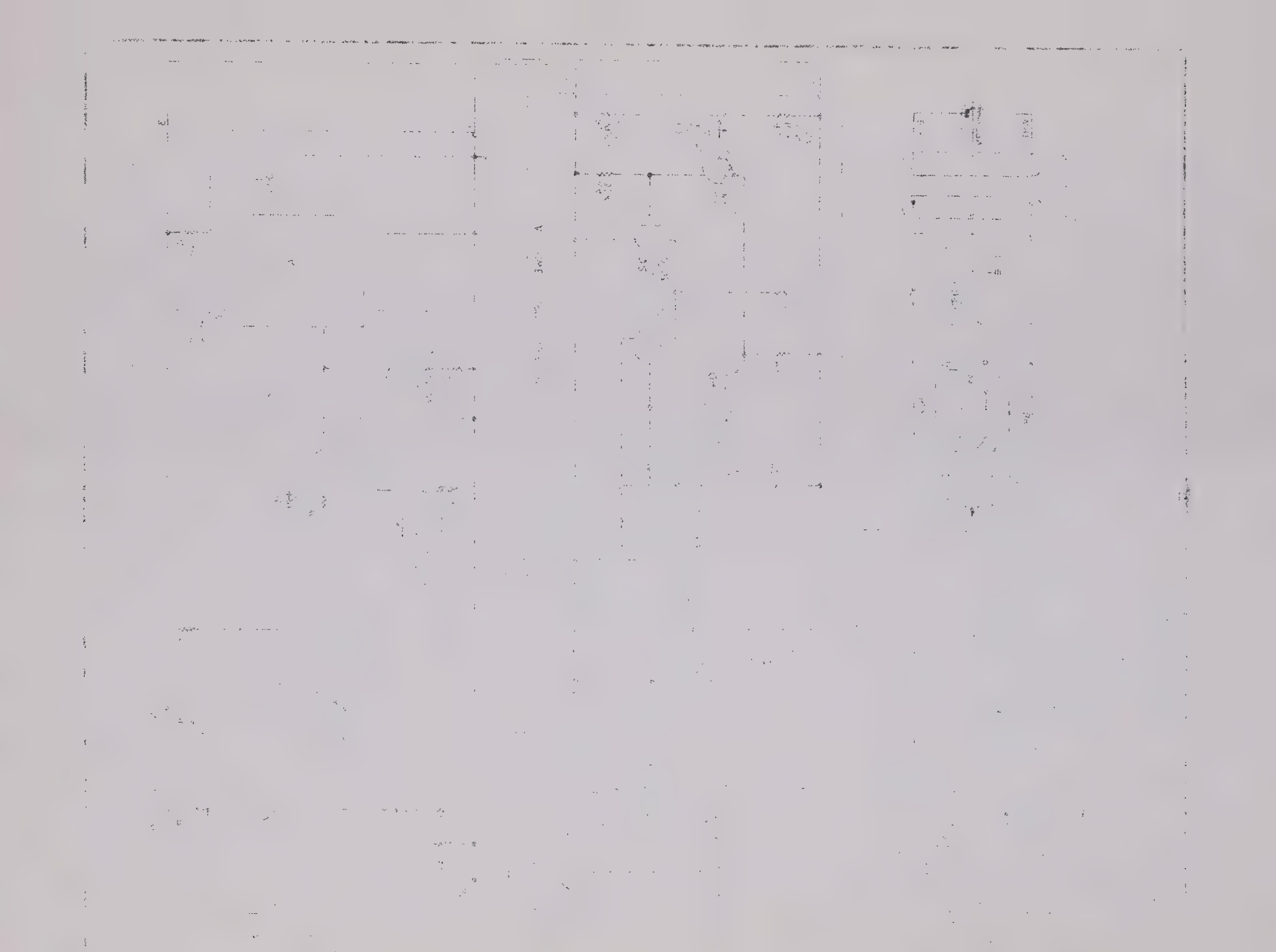
AMPLITUDE at full CCW.

RANGE at 20 kc.

115 VAC input.

No battery installed.


A1 AMPLIFIER ASSEMBLY
AMPLITUDE
R1 2K, ±20%
A3 POWER SUPPLY ASSEMBLY
A4 CHARGER ASSEMBLY
A2 METER ASSEMBLY
A5 ATTENUATOR ASSEMBLY
ALL RESISTORS EXCEPT R8 ±1/2%, 1/8W
A6 ATTENUATOR ASSEMBLY
OUTPUT
NOTES
1- ⏚ CABINET GROUND.
2- * AVERAGE VALUE SHOWN, OPTIMUM VALUE SELECTED AT FACTORY, PART MAY BE OMITTED
3- ** ON BATTERY OPERATED MODEL ONLY.
4- CAPACITOR VALUES UF UNLESS OTHERWISE SPECIFIED
5- CAPACITOR VOLTAGE 500 V UNLESS OTHERWISE SPECIFIED.
6- ALL RESISTORS ±5%, 1/2 W.
7- DOTTED CONNECTIONS AND VALUES IN PARENTHESES USED ON MODEL 603A.
8- A5 ATTENUATOR ASSEMBLY ON MODEL 602A ONLY
9- A6 ATTENUATOR ASSEMBLY ON MODEL 603A ONLY
DATE
BY
CHANGE
APPR.
GAUSSIAN NOISE GENERATOR
DATE
JUNE 14, 1965
APPROVED BY
DRAWN BY
s/d
ELGENCO INCORPORATED
SANTA MONICA, CALIFORNIA
DRAWING NUMBER
602A/603A



SECTION 7

REPLACEABLE PARTS LIST

ORDERING PARTS

Standard components may be purchased locally or from Elgenco; special parts should be ordered from Elgenco. When ordering from Elgenco, always include:

1. The Elgenco part number
2. Complete description of part including circuit designation.
3. Model and serial number of the instrument.
4. If part number is not listed, give complete description, function, and location of part.

If the part which is ordered has been replaced by a new or improved part, the new part will be supplied. Where necessary, replacement information will be provided.

REFERENCE DESIGNATORS

A	=	assembly
B	=	motor
BT	=	battery
C	=	capacitor
CP	=	coupling
CR	=	diode
DL	=	delay line
DS	=	device signaling (lamp)
E	=	misc electronic part
F	=	fuse
FL	=	filter
J	=	jack
K	=	relay
L	=	inductor
M	=	meter
MP	=	mechanical part
P	=	plug
Q	=	transistor
R	=	resistor
RT	=	thermistor
S	=	switch
T	=	transformer
TB	=	terminal board
TP	=	test point
V	=	vacuum tube, neon bulb, photocell, etc.
W	=	cable
X	=	socket
Y	=	crystal

ABBREVIATIONS

A	=	ampere
AFC	=	automatic frequency control
AMPL	=	amplifier
AV	=	average value shown, optimum value selected at factory, part may be omitted
BFO	=	beat frequency oscillator
BE CU	=	beryllium copper
BH	=	binder head
BP	=	bandpass
BRS	=	brass
CCW	=	counter-clockwise
CER	=	ceramic
CF	=	carbon film
CI	=	cad-iridite
CMO	=	cabinet mount only
COEF	=	coefficient
COM	=	common
COMP	=	composition
CONN	=	connector
CP	=	cadmium plate
CRT	=	cthode-ray tube
CW	=	clockwise
DEG	=	degrees
DEV	=	deviation
DI	=	dioxide
DR	=	drive
ELECT	=	electrolytic
ENCAP	=	encapsulated
EXT	=	external
F	=	farad
FH	=	flat head
FIL H	=	fillister head
FXD	=	fixed
GE	=	germanium
GL	=	glass
GMV	=	guaranteed minimum value
GRD	=	ground(ed)
H	=	henry
HEX	=	hexagonal
HG	=	mercury
HPF	=	high pass filter
HR	=	hour(s)
IF	=	intermediate freq
IMPG	=	impregnated
INCD	=	incandescent
INCL	=	include(s)
INS	=	insulation(ed)
INT	=	internal
K	=	kilohm
LIN	=	linear taper
LK WASH	=	lock washer
LOG	=	logarithmic taper
LPF	=	low pass filter
M	=	megohm
MAX	=	maximum
MBO	=	may be omitted in some cases
MF	=	metal film
MFR	=	manufacturer
MIN	=	minute(s)
MINAT	=	miniature
MOM	=	momentary
MP	=	mylar paper
MS	=	millisecond
M/S	=	machine screw
MTG	=	mounting
MY	=	mylar
NC	=	normally closed
NE	=	neon
NICAD	=	nickel-cadmium
NI PL	=	nickel plate
NO	=	normally open
NPO	=	negative positive zero (zero temperature coefficient)
NRFR	=	not recommended for field replacement
NS	=	nanosecond
NSR	=	not separately replaceable
OBD	=	order by description
OF	=	oil filled
OH	=	oval head
OX	=	oxide
P	=	paper
PC	=	printed circuit
PF	=	picofarad
PH BRZ	=	phosphor bronze
PHL	=	Phillips
PIV	=	peak inverse voltage
PK	=	peak
P/O	=	part of
POLY	=	polystyrene
PORC	=	porcelain
POS	=	position(s)
PP	=	peak-to-peak
PT	=	point
RECT	=	rectifier
RF	=	radio frequency
RH	=	round head
RMO	=	rack mount only
RMS	=	root-mean-square
ROT	=	rotary
RS	=	recommended spaces, one year isolated service
SB	=	slow-blow
SCR	=	silicon controlled rectifier
SE	=	selenium
SEC	=	second(s)
SECT	=	section(s)
SEMICON	=	semiconductor
SI	=	silicon
SIL	=	silver
SL	=	slide
SM	=	silver mica
SPL	=	special
SST	=	stainless steel
SR	=	split ring
STL	=	steel
SW	=	switch
TA	=	tantalum
TC	=	temperature coefficient
TD	=	time delay
TI	=	titanium
TOG	=	toggle
TOL	=	tolerance
TRIM	=	trimmer
TQ	=	total quantity
UF	=	microfarad
UH	=	microhenry
US	=	microsecond
VAR	=	variable
W	=	watts
W/	=	with
W/O	=	without
WVDC	=	working volts dc
WW	=	wirewound

REFERENCE DESIGNATOR	ELGENCO STOCK NO.	RS	TQ	DESCRIPTION	MRF.	MFR. PART NO.
A1				ASSY, AMPLIFIER		
	8611-9101	1	1	Model 603A:	15455	8611-9101
	8612-1101	1	1	Model 624A: (EXCLUDING A1A1, A1C3, A1C4, A1R13, A1C8, A1C9)	15455	8612-1101
A1A1				ASSY, NOISE SOURCE AND PREAMPLIFIER, ENCAP NRFR		
	8611-9111	1	1	Model 603A	15455	8611-9111
	884x-xxxx	1	1	Model 624A: OBD	15455	884x-xxxx
A1C1				C, FXD ELECT.		
				Model 603A; PREFIX 029-, 044-, 046-, 062-		
				Model 624A: PREFIX 050-, 063-		
	4000-6107	1		100 UF ±20% 25WVDC	15455	4000-6107
				Model 603A: PREFIX 078-, 079-		
				Model 624A: PREFIX 080-		
	4000-8686	1	1	68 UF ±20%, 50 WVDC	15455	4000-8686
A1C2	4000-3277	1		C, FXD ELECT 270 UF ±20% 12 WVDC	15455	4000-3277
A1C3				C, FXD ELECT		
	4000-3277	1		Model 603A: 270 UF ±20% AV 12 WVDC	15455	4000-3277
				Model 624A: FACTORY SELECTED, NO AV, OBD	15455	
A1C4		1	2	C, FXD MP		
	3456-0562			Model 603A: 0.0056 UF ±5% AV 600 WVDC	72136	6MPD-1-562J
				Model 624A: FACTORY SELECTED, NO AV, OBD	72136	obd
A1C5				C, FXD SM		
	3155-0271	1	2	Model 603A: 270 PF ±5% AV 500 WVDC	72136	CM05FD271J03
				Model 624A: NOT USED		
A1C5A				C, FXD SM		
				Model 603A: TRIM, NO AV		
				Model 624A: NOT USED		
A1C6	4000-3277	1		C, FXD ELECT 270 UF ±20% 12 WVDC	15455	4000-3277
A1C7	4000-3277	1		C, FXD ELECT 270 UF ±20% 12 WVDC	15455	4000-3277
A1C8				C, FXD ELECT		
				Model 603A: PREFIX 029-, 044-, 046-		
	4000-3277	1		270 UF ±20% 12 WVDC	15455	4000-3277
				Model 603A: PREFIX 062-, 078-, 079-		
	4000-1336	1	1	33UF ±20% 6 WVDC	15455	4000-1336
				Model 624A: FACTORY SELECTED, NO AV, OBD		
A1C9				SAME AS A1C4		
A1C10				SAME AS A1C5		
A1C11	4000-0337	1	3	C, FXD ELECT 330 UF ±20% 3 WVDC	15455	4000-0337
A1C12 THRU A1C13				TYPICALLY NOT USED; IF USED		
	3155-0910	0		C, FXD SM 91 PF ±5% 500 WVDC	72136	CM05FD910J03
A1C14				C, FXD ELECT		
				Model 603A: PREFIX 029-, 044-, 046-		
				Model 624A: PREFIX 050-		
	4090-7257	1	1	250 UF + 100%-10% 30 WVDC	56289	34D257H030GJ4
				Model 603A: PREFIX 062-,078-, 079		
				Model 624A: PREFIX 063-, 080		
	4099-8157	1	1	150 UF +75%-10% 40 WVDC	56289	34D157G040FJ4
A1C15	4000-6107	1		C, FXD ELECT 100 UF ±20% 25 WVDC	15455	4000-6107
A1C16	4000-4107	1	1	C, FXD ELECT 100 UF ±20% 15 WVDC	15455	4000-4107
A1Q1	9410-0003	2	2	TRANSISTOR, SI PNP SELECTED	15455	9410-0003
A1Q2	9410-0002	1	1	TRANSISTOR, SI NPN SELECTED	15455	9410-0002
	9410-0004			NOTE SOME UNITS MAY USE AT A1Q2	15455	9410-0004
A1Q3	9410-0003	2	2	TRANSISTOR, SI PNP SELECTED	15455	9410-0003
A1Q4	9410-0004	2	1	TRANSISTOR, SI NPN SELECTED	15455	9410-0004
A1R1				R, FXD		
				Model 603A: PREFIX 029-, 044-, 046-		
				Model 624A: PREFIX 050-		

REFERENCE DESIGNATOR	ELGENCO STOCK NO.	RS	TQ	DESCRIPTION	MFR.	MFR. PART NO.
A2CR1,						
A2CR2	9310-2002	2	2	DIODE, GE	15455	9310-2002
A2M1	2201-0003	1	1	METER, OUTPUT 5V RMS SCALE	15455	2201-0003
A2R1	1919-4751	1	2	R, FXD MF 4.99K ±1% 1/8W	19701	MF5C-D-4751F
A2R2	0101-8000	1	1	R, VAR COMP 800 OHM ±20% 3/10 W	15455	0101-8000
A2R3, A2R4	1911-3831	1	2	R, FXD MF 3.83K ±1% 1/4W	19701	MF6C-D-3831F
A3	8611-9103		1	ASSY, POWER SUPPLY	15455	8611-9103
A3C1, A3C2	4090-9307	1	1	C, FXD 300 UF +75 -10% 75 WVDC A3C2 TYPICALLY NOT USED	15455	4090-9307
A3CR1	9200-0009	1	1	DIODE, SI ZENER	15455	9200-0009
A3CR2, A3CR3	9210-0009	2	2	DIODE, SI RECT	15455	9210-0009
A3Q1 THRU A3Q4				Model 603A: PREFIX 029-		
	9510-0003	4	4	TRANSISTOR, GE, PNP, SELECTED	15455	9510-0003
	9410-0010	4	4	ALL OTHERS: TRANSISTOR, SI, PNP	15455	9410-0010
A3Q5	9510-0002	2	1	TRANSISTOR, GE PNP	15455	9510-0002
A3R1	1912-4992	1	1	R, FXD MF 49.9K ±1% 1/2W	75042	CEC-TO-4992F
A3R2	0203-2501	1	1	R, VAR WW 2.5K ±5% 1W	15455	0203-2501
A3R3	1919-1002	1	1	R, FXD MF 10K ±1% 1/8W	19701	MF5C-D-1002F
A3R4				R, FXD COMP ±5% 1/2W		
	1352-3002	1	3	Model 603A: PREFIX 029- 30K	78488	RC20GF303J
	1352-4302	1	2	ALL OTHERS: 43K	78488	RC20GF433J
A3R5	1352-3901	1	1	R, FXD COMP 3.9K ±5% 1/2W	78488	RC20GF392J
A3R6				R, FXD COMP ±5% 1/2W		
	1352-5601	1	1	Model 603A: PREFIX 029- 5.6K	78488	RC20GF562J
	1352-1002	1	2	ALL OTHERS: 10K	78488	RC20GF103J
A3R7				R, FXD COMP ±5% 1/2W		
	1352-3002	1	3	Model 603A: PREFIX 029- 30K	78488	RC20GF303J
	1352-4302	1	2	ALL OTHERS: 43K	78488	RC20GF433J
A3R8	1352-1002	1	2	R, FXD COMP 10K ±5% 1/2W	78488	RC20GF103J
A3R9				R, FXD COMP ±5% 1/2W		
	1352-1502	1	3	Model 603A: PREFIX 029- 15K	78488	RC20GF153J
	1352-4701	1	1	ALL OTHERS: 4.7K	78488	RC20GF472J
A3R10				R, FXD COMP ±5% 1/2W		
	1352-4701	1	1	Model 603A: PREFIX 029- 4.7K	78488	RC20GF472J
	1352-7501	1	2	ALL OTHERS: 7.5K	78488	RC20GF752J
A3R11	1456-0250	1	1	R, FXD WW 25 OHM ±5% 5W	56289	452E2505
A4	8611-8104	1	1	ASSY, BATTERY CHARGER BATTERY OPTION ONLY	15455	8611-8104
A4CR1 THRU						
A4CR5	9210-5003	2	5	DIODE, SI	15455	9210-5003
A4Q1	9410-0004	2	2	TRANSISTOR SI	15455	9410-0004
A4R1	1352-0820	1	1	R, FXD COMP 82 OHM AV ±5% 1/2W	78488	RC20GF820J
A4R2	1352-3002	1	1	R, FXD COMP 30K AV ±5% 1/2W	78488	RC20GF303J
A5				ASSY, ATTENUATOR		
	8611-8105		1	USED ON SOME MODEL 624A'S ONLY	15455	8611-8105
A5C1 THRU						
A5C4	3155-0150	1	4	C, FXD SM 15 PF ±5% 500 WVDC	72136	CM05CD150J03
A5R1	1939-2440	1	3	R, FXD MF 244.4 OHM ±1/2%, 1/8W	19701	MFSC-D-244R4-D
A5R2 THRU						
A5R3	1939-1981	1	4	R, FXD MF 1.98K ±1/2% 1/8W	19701	MF5C-D-1981-D
A5R4	1939-2440	1	3	SAME AS A5R1		
A5R5 THRU A5R6				SAME AS A5R2		
A5R7				SAME AS A5R1		
A5R8	1352-2703	1	1	R, FXD COMP 270K ±5% 1/2W	78488	RC20GF274J
A5R9	1939-2200	1	1	R, FXD MF 220 OHM ±1/2% 1/8W	19701	MF5C-D-2200-D
A5S1	7311-8201		1	SW, ROT 5 POS NOT SEPARATELY REPLACEABLE	15455	7311-8201

Replaceable Parts List

REFERENCE DESIGNATOR	ELGENCO STOCK NO.	RS	TQ	DESCRIPTION	MFR.	MFR. PART NO.
	1352-1502	1	2	COMP 15K ±5% 1/2W Model 603A: PREFIX 062-, 078- Model 624A: PREFIX 063	78488	RC20GF153J
	1919-1502	1	1	MF 15K ±1% 1/8W Model 603A: PREFIX 079- Model 624A: PREFIX 080-	19701	MF5C-D-1502F
	1919-1961	1	1	MF 1.96K ±1% 1/8W	19701	MF5C-D-1502F
A1R2	1392-6801	1	2	R, FXD COMP 6.8K ±10% 1/2W	78488	RC20GF682K
A1R3	1352-8200	1	1	R, FXD COMP 820 OHM ±5% 1/2W	78488	RC20GF821J
A1R4	0601-2500	1	1	R, VAR COMP 250 OHM ±20% 3/10W	15455	0601-2500
A1R5	1352-0220	1	1	R, FXD COMP 22 OHM ±5% AV 1/2W	78488	RC20GF220J
A1R6	1919-4990	1	2	R, FXD MF 499 OHM ±1% 1/8W	19701	MF5C-D-4990F
A1R7	1352-3002	1	3	R, FXD COMP 30K ±5% 1/2W	78488	RC20GF303J
A1R8	1352-1502	1	2	R, FXD COMP 15K ±5% 1/2W	78488	RC20GF153J
A1R9				R, FXD COMP 18K Model 603A: PREFIX 029-, 044-		
	1392-1802	1	1	±10% 1/2W	78488	RC20GF183K
	1352-1802	1	1	ALL OTHERS: ±5% 1/2W	78488	RC20GF183J
A1R10				R, FXD COMP Model 603A: PREFIX 029-, 044-		
	1352-8201	1	1	8.2K ±5% 1/2W	78488	RC20GF822J
	1352-7501	1	2	ALL OTHERS: 7.5K ±5% 1/2W	78488	RC20GF752J
A1R11				R, FXD COMP Model 603A: PREFIX 029-, 044-		
	1392-6801	1	2	6.8K ±10% 1/2W	78488	RC20GF682K
	1352-8201			ALL OTHERS: 8.2K ±5% 1/2W	78488	RC20GF822J
A1R12	1352-2201	1	1	R, FXD COMP 2.2K ±5% 1/2W	78488	RC20GF222J
A1R13				R, FXD COMP		
	1352-2708	1	1	Model 603A: 2.7 OHM AV ±5% 1/2W	78488	RC20GF279J
		1	1	Model 624A: FACTORY SELECTED, NO AV	78488	OBD
A1R14				R, FXD COMP		
	1352-0150	1	1	Model 603A: 15 OHM AV ±5% 1/2W Model 624A: NOT USED	78488	RC20GF150J
A1R15				R, FXD COMP		
	1352-0330			Model 603A: 33 OHM AV ±5% 1/2W Model 624A: NOT USED	78488	RC20GF330J
A1R16	1912-3320	1	1	R, FXD MF 332 OHM ±1% 1/2W	75042	CEC-TO-3320F
A1R17				R, FXD MF ±1% Model 603A: PREFIX 029-, 044-, 046-, 062-		
	1912-5362	1	1	Model 624A: 53.6K 1/2W Model 603A: PREFIX 0.78-, 0.79-	75042	CEC-TO-5362F
	1919-6042	1	1	60.4K 1/8W	19701	MF5C-D-6042F
A1R18	1919-4751	1	1	R, FXD MF 4.75K ±1% 1/8W Model 603A: PREFIX 062-, FACTORY TRIMMED WITH 5% RESISTOR	19701	MF5C-0-4751F
A1R19	1352-1001	1		R, FXD COMP 1K ±5% 1/2W	78488	RC-20-102J
A1R20	1919-4991	1	2	R, FXD MF 4.99K ±1% 1/8W	19701	MF5C-D-4991F
A1R21	1919-4990	1	2	R, FXD MF 499 OHM ±1% 1/8W	19701	MF5C-D-4990F
A1R22, A1R23	1912-9090	1	2	R, FXD MF 909 OHM ±1% 1/2W	75042	CEC-TO-9090F
A1R24				R, FXD		
	1352-1800	1	1	Model 603A: COMP 180 OHM ±5% 1/2W	78488	RC20GF181J
	1919-5760	1	1	Model 624A: MF 576 OHM ±1% 1/2W	19701	MF5C-D-5760F
A1R25				F, FXD COMP Model 603A: PREFIX 029-, 044-		
	1352-6201	1	1	6.2K ±5% 1/2W	78488	RC20GF622J
	1352-5601			ALL OTHERS: 5.6K ±5% 1/2W	78488	RC20GF562J
A1S1	7311-8101	1	1	Model 603A: SW, ROT 3 POLE POS Model 624A: NOT USED	15455	7311-8101
A2	8611-8102	1	1	ASSY, OUTPUT METER	15455	8611-8102
A2C1	3155-0150	1	1	C, FXD SM 15 PF AV ±5% 500 WVDC	72136	CM05CD150J03
A2C2, A2C3	4000-0337	1	3	C, FXD ELECT 330 UF ±20% 3 WVDC	15455	4000-0337

REFERENCE DESIGNATOR	ELGENCO STOCK NO.	RS	TQ	DESCRIPTION	MFR.	MFR. PART NO.
A6				ASSY, ATTENUATOR		
				ALL MODEL 603A'S AND HIGHER		
	8611-9105	1	1	FREQUENCY MODEL 624A'S	15455	8611-9105
A6R1	1352-2703	1	1	R, FXD COMP 270K ±5% 1/2W	78488	RC20GF274J
A6R2 THRU						
A6R5	1939-1981	1	4	R, FXD MF 1.98K ±1/2% 1/8W	19701	MF5C-D-1981-D
A6R6 THRU						
A6R8	1939-2440	1	3	R, FXD MF 244.4 OHM ±1/2% 1/8W	19701	MF5C-D-244R4-D
A6R9	1939-2200	1	1	R, FXD MF 220 OHM ±1/2% 1/8W	19701	MF5C-D-2200-D
A6S1	7311-9201	0	1	SW, ROT 5 POS. (NOT SEPARATELY REPLACEABLE)	15455	7311-9201
BT1				BATTERY NICAD RECHARGEABLE 0.6		
	7340-1181	1	1	AMP HOUR, BATTERY OPTION ONLY	88220	33.6V/600SC
C1A,B	3986-4103	1	1	C, FXD CER 2 X 0.01 UF GMV 1000 WVDC	56289	5HK-2S10
DS1	7110-2021	1	1	LAMP, LINE	15455	7110-2021
F1	7210-2002	10	1	FUSE, 3 AG, 1/8AMP 250 VOLT SB	75915	313.215
J1	7510-1104	1	1	CONN, POWER	15455	7510-1104
J2				ASSY, CONN		
	7471-0017	1	1	BINDING POST, RED	15455	7471-0017
	7471-0018	1	1	BINDING POST, BLACK	15455	7471-0018
	7471-0019	1	1	DUAL MOUNTING BASE, BLACK	15455	7471-0019
J3				CONNECTOR, BNC (BNCR OPTION ONLY)		
R1	0102-2001	1	1	R, VAR COMP 2K ±20% 1/2W	15455	0102-2001
S1A,B	7311-8001	1	1	SW, TOG, 2PST	88140	CH8360K6
S2	7311-6901	1	1	SW, SL DPDT	15455	7311-6901
T1	6111-8001	1	1	TRANSFORMER, RECT	15455	6111-8001
W1	7080-0004	1	1	CABLE, POWER	15455	7080-0004
	7320-0106	1	2	KNOB, BAR	15455	7320-0106
	7320-0105	1	1	KNOB, ROUND	15455	7320-0105
	9711-6003	0	2	COVER, SIDE	15455	9711-6003
	9711-8002	0	1	PLATE, FRONT	15455	9711-8002
	9711-8003	0	1	PLATE, REAR	15455	9711-8003
	9711-8004	0	1	PLATE, POWER SUPPLY	15455	9711-8004
	9711-6018	0	1	SHIELD, OUTPUT CONNECTOR	15455	9711-6018
	9711-8005	0	2	SHIELD, SIDE	15455	9711-8005
	9711-8006	0	1	CLAMP, BATTERY	15455	9711-8006
				BATTERY OPTION ONLY		
	7330-0001	0	4	FOOT	15455	7330-0001
	7795-1191		1	MANUAL, OPERATING AND SERVICE	15455	7795-1191
				CABINET MODELS		
	9711-6004	0	1	COVER, TOP	15455	9711-6004
	9711-6005	0	1	COVER, BOTTOM	15455	9711-6005
	9711-6016	0	4	ROD	15455	9711-6016
	9711-6021	0	1	STAND, TILT	15455	9711-6021
				PANEL;		
				Model 603A; PREFIX 029-, 044-, 046-, 062-		
	9711-9001	0	1	FRONT, GRAINED	15455	9711-9001
	9711-6002	0	1	REAR, GRAINED	15455	9711-6002
				Model 603A; PREFIX 078-, 079-		
	9711-9002	0	1	FRONT, PAINTED, GREY	15455	9711-9002
	9712-9002	0	1	REAR, PAINTED, GREY	15455	9712-9002
				Model 624A; PREFIX 050-, 063-		
	9712-1001	0	1	FRONT, GRAINED	15455	9712-1001
	9711-6002	0	1	REAR, GRAINED	15455	9711-6002
				Model 624A; PREFIX 080-		
	9712-1002	0	1	FRONT, PAINTED, GREY	15455	9712-1002
	9712-9002	0	1	REAR, PAINTED, GREY	15455	9712-9002
				FULL RACK WIDTH OPTION		
	9711-6025	0	1	COVER, TOP	15455	9711-6025

REFERENCE DESIGNATOR	ELGENCO STOCK NO.	RS	TQ	DESCRIPTION	MFR.	MFR. PART NO.
	9711-6026	0	1	COVER, BOTTOM	15455	9711-6026
	9711-6020	0	4	ROD	15455	9711-6020
	9711-6024	0	1	STAND, TILT	15455	9711-6024
				EAR MOUNT		
				Model 603A; PREFIX 029-, 044-, 046-, 062-		
				Model 624A; PREFIX 046-, 063-		
	9711-6027	0	2	GRAINED	15455	9711-6027
				Model 603A; PREFIX 078-, 079-		
				Model 624A; PREFIX 080-		
	9712-9006	0	2	PAINTED, GREY	15455	9712-9006
				PANEL,		
				Model 603A; PREFIX 029-, 044-, 046-, 062-		
	9711-9022	0	1	FRONT, GRAINED	15455	9711-9022
	9711-6023	0	1	REAR, GRAINED	15455	9711-6023
				Model 603A; PREFIX 078-, 079-		
	9711-9009	0	1	FRONT, PAINTED GREY	15455	9711-9009
	9712-9005	0	1	REAR, PAINTED GREY	15455	9712-9005
				Model 624A; PREFIX 040-, 063-,		
	9712-1023	0	1	FRONT, GRAINED	15455	9712-1023
	9711-6023	0	1	REAR, GRAINED	15455	9711-6023
				Model 624A; PREFIX 080-		
	9712-1021	0	1	FRONT, PAINTED, GREY	15455	9712-1021
	9712-9005	0	1	REAR, PAINTED, GREY	15455	9712-9005

Code List Of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page.

00000	U.S.A. Common	Any supplier of U.S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00213	Sage Electronics Corp.	Rochester, N.Y.
00334	Humidail Co.	Cotton, Calif.
00335	Westrex Corp.	New York, N.Y.
00373	Garlock Packing Co. Electronic Products Div.	Camden, N.J.
00656	Aerovox Corp.	New Bedford, Mass.
00779	Amp, Inc.	Harrisburg, Pa.
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.
00853	Sangamo Electric Company Ordill Division (Capacitors)	Marion, Ill.
00866	Goe Engineering Co.	Los Angeles, Calif.
00891	Carl E. Holmes Corp.	Los Angeles, Calif.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Calif.
01281	TRW Semiconductors, Inc.	Lawndale, Calif.
01295	Texas Instruments, Inc. Transistor Products Div.	Dallas, Texas
01349	The Alliance Mfg. Co.	Alliance, Ohio
01561	Chassi-Trak Corp.	Indianapolis, Ind.
01589	Pacific Relays, Inc.	Van Nuys, Calif.
01930	Amerock Corp.	Rockford, Ill.
01961	Pulse Engineering Co.	Santa Clara, Calif.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.
02286	Cole Mfg. Co.	Palo Alto, Calif.
02660	Amphenol-Borg Electronics Corp.	Chicago, Ill.
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N.J.
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Calif.
03508	G.E. Semiconductor Products Dept.	Syracuse, N.Y.
03705	Apex Machine & Tool Co.	Dayton, Ohio
03797	Eldema Corp.	El Monte, Calif.
03877	Transistron Electronic Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co.	Morristown, N.J.
03954	Air Marine Motors, Inc.	Los Angeles, Calif.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.
04062	Elmenco Products Co.	New York, N.Y.
04222	Hi-Q Division of Aerovox	Myrtle Beach, S.C

04222	Hi-Q Division of Aerovox	Myrtle Beach, S.C.

04298	Elgin National Watch Co. Electronics Division	Burbank, Calif.
04651	Sylvania Electric Prods., Inc. Electronic Tube Div.	Mountain View, Calif.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona
04732	Filtron Co., Inc., Western Div.	Culver City, Calif.
04773	Automatic Electric Co.	Northlake, Ill.
04777	Automatic Electric Sales Corp.	Northlake, Ill.
04796	Sequoia Wire & Cable Co.	Redwood City, Calif.
04811	Precision Coil Spring Co.	El Monte, Calif.
04870	P.M. Motor Co.	Chicago 44, Ill.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Calif.
05277	Westinghouse Electric Corp., Semiconductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	San Mateo, Calif.
05593	Illumitronic Engineering Co.	Sunnyvale, Calif.
05624	Barber Colman Co.	Rockford, Ill.
05728	Tiffen Optical Co.	Roslyn Heights, Long Island, N.Y.
05729	Metropolitan Telecommunications Corp. Metro Cap. Division	Brooklyn, N.Y.
05783	Stewart Engineering Co.	Santa Cruz, Calif.
05820	Wakefield Engineering Co.	Wakefield, Mass.
06004	The Bassick Co.	Bridgeport, Conn.
06175	Bausch and Lomb Optical Co.	Rochester, N.Y.
06402	E.T.A. Products Co. of America	Chicago, Ill.
06540	Amatom Electronic Hardware Co., Inc.	New Rochelle, N.Y.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N.H.
06751	U.S. Semcor Division of Nuclear Corp. of America	Phoenix, Arizona
06812	Torrington Mfg. Co., West Div.	Van Nuys, Calif.
07115	Corning Glass Works Electronic Components Dept.	Bradford, Pa.
07126	Digitran Co.	Pasadena, Calif.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp. Electronic Tube Div.	Elmira, N.Y.
07149	Filmohm Corp.	New York, N.Y.
07233	Cinch-Graphik Co.	City of Industry, Calif.
07261	Avnet Corp.	Los Angeles, Calif.
07263	Fairchild Semiconductor Corp.	Mountain View, Calif.
07322	Minnesota Rubber Co.	Minneapolis, Minn.
07387	The Birtcher Corp.	Los Angeles, Calif.
07700	Technical Wire Products	Springfield, N.J.
07910	Continental Device Corp.	Hawthorne, Calif.
07933	Rheem Semiconductor Corp.	Mountain View, Calif.
07966	Shockley Semi-Conductor Laboratories	Palo Alto, Calif.
08145	U.S. Engineering Co.	Los Angeles, Calif.
08358	Burgess Battery Co.	Niagara Falls, Ontario, Canada
08717	Sloan Company	Burbank, Calif.
08718	Cannon Electric Co., Phoenix Div.	Phoenix, Arizona
08792	CBS Electronics Semiconductor Operations, Div. of C.B.S., Inc.	Lowell, Mass.
08984	Mel-Rain	Indianapolis, Ind.
09026	Babcock Relays, Inc.	Costa Mesa, Calif.
09134	Texas Capacitor Co.	Houston, Texas
09145	Atohm Electronics	Sun Valley, Calif.
09250	Electro Assemblies, Inc.	Chicago, Ill.
09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
09664	The Bristol Co.	Waterbury, Conn.
10214	General Transistor Western Corp.	Los Angeles, Calif.
10411	Ti-Tal, Inc.	Berkeley, Calif.
10646	Carborundum Co.	Niagara Falls, N.Y.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Calif.
11312	Microwave Electronics Corp.	Palo Alto, Calif.
11534	Duncan Electronic, Inc.	Santa Ana, Calif.
11711	General Instrument Corporation Semiconductor Division	Newark, N.J.
11717	Imperial Electronic, Inc.	Buena Park, Calif.
11870	Melabs, Inc.	Palo Alto, Calif.
12697	Clarostat Mfg. Co.	Dover, N.H.
12859	Nippon Electric Co., Ltd.	Tokyo, Japan
12930	Delta Semiconductor, Inc.	Newport Beach, Calif.
13103	Thermolly	Dallas, Texas
13396	Telefunken (G.M.B.H.)	Hannover, Germany
13835	Midland Mfg. Co.	Kansas City, Kansas
14099	Sem-Tech	Newbury Park, Calif.
14193	Calif. Resistor Corp.	Santa Monica, Calif.
14298	American Components, Inc.	Conshohocken, Pa.
14655	Cornell Dubilier Elec. Corp.	So. Plainfield, N.J.
14960	Williams Mfg. Co.	San Jose, Calif.
15455	Elgenco, Inc.	Santa Monica, Calif.
15909	The Daven Co.	Livingston, N.J.
16307	Spruce Pine Mica Co.	Spruce Pine, N.C.
16352	Computer Diode Corp.	Lodi, N.J.
16688	De Jur-Amsco Corporation	Long Island City 1, N.Y.
16758	Delco Radio Div. of G.M. Corp.	Kokomo, Ind.
18873	E.I. DuPont and Co., Inc.	Wilmington, Del.
19315	Eclipse Pioneer, Div. of Bendix Aviation Corp.	Teterboro, N.J.
19500	Thomas A. Edison Industries, Div. of McGraw-Edison Co.	West Orange, N.J.
19701	Electra Manufacturing Co.	Kansas City, Mo.
20183	Electronic Tube Corp.	Philadelphia, Pa.
21226	Executive, Inc.	New York, N.Y.
21520	Fansteel Metallurgical Corp.	No. Chicago, Ill.
21335	The Fafnir Bearing Co.	New Britain, Conn.
21964	Fed. Telephone and Radio Corp.	Clifton, N.J.
24446	General Electric Co.	Schenectady, N.Y.
24455	G.E. Lamp Division Nela Park,	Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
26365	Gries Reproducer Corp.	New Rochelle, N.Y.
26462	Grobel File Co. of America, Inc.	Carlstadt, N.J.
26992	Hamilton Watch Co.	Lancaster, Pa.
33173	G.E. Receiving Tube Dept.	Owensboro, Ky.
35434	Lectrohm, Inc.	Chicago, Ill.
36196	Stanwyck Corp.	Hawkesbury, Ontario, Canada
37942	P.R. Mallory & Co., Inc.	Indianapolis, Ind.
39543	Mechanical Industries Prod. Co.	Akron, Ohio
40920	Miniature Precision Bearings, Inc.	Keene, N.H.
42190	Muter Co.	Chicago, Ill.
43990	C.A. Norgren Co.	Engelwood, Colo.
44655	Ohmite Mfg. Co.	Skokie, Ill.
47904	Polaroid Corp.	Cambridge, Mass.
48620	Precision Thermometer and Inst. Co.	Philadelphia, Pa.
49956	Raytheon Company	Lexington, Mass.
52090	Rowan Controller Co.	Baltimore, Md.
54294	Shallcross Mfg. Co.	Selma, N.C.
55026	Simpson Electric Co.	Chicago, Ill.
55933	Sonotone Corp.	Elmsford, N.Y.
55938	Sorenson & Co., Inc.	So. Norwalk, Conn.
56137	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.
56289	Sprague Electric Co.	North Adams, Mass.
59446	Telex, Inc.	St. Paul, Minn.
59730	Thomas & Betts Co.	Elizabeth 1, N.J.
60741	Tripplett Electrical, Inc.	Bluffton, Ohio
61775	Union Switch and Signal, Div. of Westinghouse Air Brake Co.	Swissvale, Pa.
62119	Universal Electric Co.	Owosso, Mich.
63743	Ward-Leonard Electric Co.	Mt. Vernon, N.Y.
64959	Western Electric Co., Inc.	New York, N.Y.
65092	Weston Inst. Div. of Daystrom, Inc.	Newark, N.J.
66295	Wittek Manufacturing Co.	Chicago 23, Ill.
66346	Wollensak Optical Co.	Rochester, N.Y.
70276	Allen Mfg. Co.	Hartford, Conn.
70309	Allied Control Co., Inc.	New York, N.Y.
70319	Allmetal Screw Prod. Co., Inc.	Garden City, N.Y.
70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.
70563	Amperite Co., Inc.	New York, N.Y.
70903	Belden Mfg. Co.	Chicago, Ill.
70998	Bird Electronic Corp.	Cleveland, Ohio
71002	Birnbach Radio Co.	New York, N.Y.
71041	Boston Gear Works Div. of Murray Co. of Texas	Quincy, Mass.
71218	Bud Radio, Inc.	Cleveland, Ohio
71286	Camloc Fastener Corp.	Paramus, N.J.
71313	Allen D. Cardwell Electronic Prod. Corp.	Plainville, Conn.
71400	Bussmann Fuse Div. of McGraw-Edison Co.	St. Louis, Mo.
71436	Chicago Condenser Corp.	Chicago, Ill.
71450	CTS Corp.	Elkhart, Ind.
71468	Cannon Electric Co.	Los Angeles, Calif.
71471	Cinema Engineering Co.	Burbank, Calif.
71482	C.P. Clare & Co.	Chicago, Ill.
71590	Centralab Div. of Globe Union, Inc.	Milwaukee, Wis.
71700	The Cornish Wire Co.	New York, N.Y.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71753	A.O. Smith Corp., Cowley Div.	West Orange, N.J.
71785	Cinch Mfg. Corp.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72092	Eitel-McCullough, Inc.	San Bruno, Calif.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
71707	Coto Coil Co., Inc.	Providence, R.I.
72354	John E. Fast & Co.	Chicago, Ill.
72619	Dialight Corp.	Brooklyn, N.Y.
72656	General Ceramics Corp.	Keasbey, N.J.
72699	General Instrument Corp., Semiconductor Div.	Newark, N.J.
72758	Girard-Hopkins	Oakland, Calif.
72765	Drake Mfg. Co.	Chicago, Ill.
72825	Hugh H. Eby, Inc.	Philadelphia, Pa.
72928	Gudeman Co.	Chicago, Ill.
72964	Robert M. Hadley Co.	Los Angeles, Calif.
72982	Erie Resistor Corp.	Erie, Pa.
73061	Hansen Mfg. Co., Inc.	Princeton, Ind.
73076	H.M. Harper Co.	Chicago, Ill.
73138	Helipot Div. of Beckman Instruments, Inc.	Fullerton, Calif.
73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif.
73445	Amperex Electronic Co. Div. of North American Phillips Co., Inc.	Hicksville, N.Y.
73490	Beckman Helipot Corp.	So. Pasadena, Calif.
73506	Bradley Semiconductor Corp.	Hamden, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73682	George K. Garrett Co., Inc.	Philadelphia, Pa.
73734	Federal Screw Prod. Co.	Chicago, Ill.
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
73793	The General Industries Co.	Elyria, Ohio
73846	Goshen Stamping & Tool Co.	Goshen, Ind.
73899	JFD Electronics Corp.	Brooklyn, N.Y.
73905	Jennings Radio Mfg. Co.	San Jose, Calif.
74276	Signalite, Inc.	Neptune, N.J.
74455	J.H. Winns, and Sons	Winchester, Mass.
74861	Industrial Condenser Corp.	Chicago, Ill.
74868	R.F. Products Division of Amphenol-Borg Electronics Corp.	Danbury, Conn.
74970	E.F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75173	Jones, Howard B., Division of Cinch Mfg. Corp.	Chicago, Ill.
75378	James Knights Co.	Sandwich, Ill.

From: FSC. Handbook Supplements
H4-1 Dated OCTOBER 1963
H4-2 Dated MARCH 1962

Code List Of Manufacturers (Cont'd)

75382 Kulka Electronic Corporation Mt. Vernon, N.Y.
75818 Lenz Electric Mfg. Co. Chicago, Ill.
75915 Littlefuse, Inc. Des Plaines, Ill.
76005 Lord Mfg. Co. Erie, Pa.
76210 C.W. Marwedel San Francisco, Calif.
76433 Micamold Electronic Mfg. Corp. Brooklyn, N.Y.
76487 James Millen Mfg. Co., Inc. Malden, Mass.
76493 J.W. Miller Co. Los Angeles, Calif.
76530 Monadnock Mills San Leandro, Calif.
76545 Mueller Electric Co. Cleveland, Ohio
76854 Oak Manufacturing Co. Crystal Lake, Ill.
77068 Bendix Pacific Division of Bendix Corp. No. Hollywood, Calif.
77075 Pacific Metals Co. San Francisco, Calif.
77221 Phaostron Instrument and Electronic Co. So. Pasadena, Calif.
77250 Phoell Mfg. Co. Chicago, Ill.
77252 Philadelphia Steel and Wire Corp. Philadelphia, Pa.
77342 Potter and Brumfield, Div. of American Machine and Foundry Princeton, Ind.
77630 Radio Condenser Co. Camden, N.J.
77638 Radio Receptor Co., Inc. Brooklyn, N.Y.
77764 Resistance Products Co. Harrisburg, Pa.
77969 Rubbercraft Corp. of Calif. Torrance, Calif.
78189 Shakeproof Division of Illinois Tool Works Elgin, Ill.
78283 Signal Indicator Corp. New York, N.Y.
78290 Struthers-Dunn, Inc. Pitman, N.J.
78452 Thompson-Bremer & Co. Chicago, Ill.
78471 Tilley Mfg. Co. San Francisco, Calif.
78488 Stackpole Carbon Co. St. Marys, Pa.
78493 Standard Thomson Corp. Waltham, Mass.
78553 Tinnerman Products, Inc. Cleveland, Ohio
78790 Transformer Engineers Pasadena, Calif.
78947 Ucinite Co. Newtonville, Mass.
79142 Veeder Roof, Inc. Hartford, Conn.
79251 Wenco Mfg. Co. Chicago, Ill.
79727 Continental-Wirt Electronics Corp. Philadelphia, Pa.
79963 Zierick Mfg. Corp. New Rochelle, N.Y.
80031 Mepco Division of Sessions Clock Co. Morristown, N.J.
80120 Schnitzer Alloy Products Elizabeth, N.J.
80310 Times Facsimile Corp. New York, N.Y.
80131 Electronic Industries Association. Any brand tube meeting EIA standards. Washington, D.C.
80207 Unimax Switch, Div. of W.L. Maxson Corp. Wallingford, Conn.
80223 United Transformer Corp. New York, N.Y.
80248 Oxford Electric Corp. Chicago, Ill.
80294 Bourns Laboratories, Inc. Riverside, Calif.
80411 Arco Div. of Robertshaw Fulton Controls Co. Columbus 16, Ohio
80486 All Star Products, Inc. Defiance, Ohio
80509 Avery Adhesive Label Corp. Monrovia, Calif.
80583 Hammerlund Co., Inc. New York, N.Y.
80640 Stevens, Arnold Co., Inc. Boston, Mass.
81030 International Instruments, Inc. New Haven, Conn.
81073 Grayhill Co. LaGrange, Ill.
81095 Triad Transformer Corp. Venice, Calif.
81312 Winchester Electronics Co., Inc. Norwalk, Conn.
81349 Military Specification .....
81415 Wilkor Products, Inc. Cleveland, Ohio
81453 Raytheon Mfg. Co., Industrial Components Div. Indust. Tube Operations Newton, Mass.
81483 International Rectifier Corp. El Segundo, Calif.
81541 The Airpax Products Co. Cambridge, Mass.
81860 Barry Controls, Inc. Watertown, Mass.
82042 Carter Parts Co. Skokie, Ill.
82142 Jeffers Electronics Division of Speer Carbon Co. Du Bois, Pa.
82170 Allen B. DuMont Labs, Inc. Clifton, N.J.
82209 Maguire Industries, Inc. Greenwich, Conn.
82219 Sylvania Electric Products, Inc. Electronic Tube Div. Emporium, Pa.
82376 Astron Co. East Newark, N.J.
82389 Switchcraft, Inc. Chicago, Ill.
82647 Metals and Controls, Inc. Div. of Texas Instruments, Inc. Attleboro, Mass.
82866 Research Products Corp. Madison, Wis.
82877 Rotron Manufacturing Co., Inc. Woodstock, N.Y.
82893 Vector Electronic Co. Glendale, Calif.
83053 Western Washer Mfr. Co. Los Angeles, Calif.
83058 Carr Fastener Co. Cambridge, Mass.
83086 New Hampshire Ball Bearing, Inc. Peterborough, N.H.
83125 Pyramid Electric Co. Darlington, S.C.
83148 Electro Cords Co. Los Angeles, Calif.
83186 Victory Engineering Corp. Union, N.J.
83298 Bendix Corp., Red Bank Div. Red Bank, N.J.
83315 Hubbell Corp. Mundelein, Ill.
83330 Smith, Herman H., Inc. Brooklyn, N.Y.
83385 Central Screw Co. Chicago, Ill.
83501 Gavitt Wire and Cable Co., Div. of Amerace Corp. Brookfield, Mass.
83594 Burroughs Corp. Electronic Tube Div. Plainfield, N.J.
83740 Eveready Battery New York, N.Y.
83777 Model Eng. and Mfg., Inc. Huntington, Ind.
83821 Loyd Scruggs Co. Festus, Mo.
84171 Arco Electronics, Inc. New York, N.Y.
83496 A.J. Glesner Co., Inc. San Francisco, Calif.
84411 Good All Electric Mfg. Co. Ogallala, Neb.
84970 Sarkes Tarzian, Inc. Bloomington, Ind.
85454 Boonton Molding Company Boonton, N.J.
85471 A.B. Boyd Co. San Francisco, Calif.
85474 R.M. Bracamonte & Co. San Francisco, Calif.
85660 Koiled Kords, Inc. New Haven, Conn.
85911 Seamless Rubber Co. Chicago, Ill.
86197 Clifton Precision Products Clifton Heights, Pa.
86579 Precision Rubber Products Corp. Dayton, Ohio
86684 Radio Corp. of America, RCA Electron Tube Div. Harrison, N.J.
87216 Philco Corporation (Lansdale Division) Lansdale, Pa.
87473 Western Fibrous Glass Products Co. San Francisco, Calif.
87664 Van Waters & Rogers, Inc. Seattle, Wash.
87930 Tower Mfg. Corp. Providence, R.I.
88140 Cutler-Hammer, Inc. Lincoln, Ill.
88220 Gould-National Batteries, Inc. St. Paul, Minn.
88698 General Mills, Inc. Buffalo, N.Y.
89231 Graybar Electric, Inc. Co. Oakland, Calif.
89473 General Electric Distributing Corp. Schenectady, N.Y.
89636 Carter Parts Div. of Economy Baker Co. Chicago, Ill.
89665 United Transformer Co. Chicago, Ill.
90179 U.S. Rubber Co., Mechanical Goods Div. Passaic, N.J.
90970 Bearing Engineering Co. San Francisco, Calif.
91260 Connor Spring Mfg. Co. San Francisco, Calif.
91345 Miller Dial & Nameplate Co. El Monte, Calif.
91418 Radio Materials Co. Chicago, Ill.
91506 Augat Brothers, Inc. Attleboro, Mass.
91637 Dale Electronics, Inc. Columbus, Nebr.
91662 Elco Corp. Philadelphia, Pa.
91737 Gremar Mfg. Co., Inc. Wakefield, Mass.
91827 K F Development Co. Redwood City, Calif.
91929 Minneapolis-Honeywell Regulator Co., Microswitch Div. Freeport, Ill.
92180 Tru-Connector Corp. Peabody, Mass.
92196 Universal Metal Prod., Inc. Bassett Puente, Calif.
92367 Elgeet Optical Co., Inc. Rochester, N.Y.
92607 Tinsolite Insulated Wire Co. Tarrytown, N.Y.
93332 Sylvania Electric Prod., Inc. Semiconductor Div. Woburn, Mass.
93369 Robbins and Myers, Inc. New York, N.Y.
93410 Stevens Mfg. Co., Industrial Components Div., Receiving Tube Operation Quincy, Mass.
93788 Howard J. Smith, Inc. Port Monmouth, N.J.
93929 G.V. Controls Livingston, N.J.
93983 Insuline-Van Norman Ind., Inc. Electronic Division Manchester, N.H.
94137 General Cable Corp. Bayonne, N.J.
94144 Raytheon Mfg. Co., Industrial Components Div. Receiving Tube Operation Quincy, Mass.
94145 Raytheon Mfg. Co., Semiconductor Div. California Street Plant Newton, Mass.
94148 Scientific Radio Products, Inc. Loveland, Colo.
94154 Tung-Sol Electric, Inc. Newark, N.J.
94197 Curtiss-Wright Corp., Electronics Div. East Paterson, N.J.
94222 Southco Div. of S. Chester Corp. Lester, Pa.
94310 Tru Ohm Prod. Div. of Model Engineering and Mfg. Co. Chicago, Ill.
94682 Worcester Pressed Aluminum Corp. Worcester, Mass.
95023 Philbrick Researchers, Inc. Boston, Mass.
95236 Allies Products Corp. Miami, Fla.
95238 Continental Connector Corp. Woodside, N.Y.
95263 Leecraft Mfg. Co., Inc. New York, N.Y.
95264 Lerco Electronics, Inc. Burbank, Calif.
95265 National Coil Co. Sheridan, Wyo.
95275 Vitramon, Inc. Bridgeport, Conn.
95348 Gordas Corp. Bloomfield, N.J.
95354 Methode Mfg. Co. Chicago, Ill.
95987 Weckesser Co. Chicago, Ill.
96067 Huggins Laboratories Sunnyvale, Calif.
96095 Hi-Q Division of Aerovox Olean, N.Y.
96256 Thordarson-Meissner Div. of Maguire Industries, Inc. Mt. Carmel, Ill.
92696 Solar Manufacturing Co. Los Angeles, Calif.
96330 Carlton Screw Co. Chicago, Ill.
96341 Microwave Associates, Inc. Burlington, Mass.
96501 Excel Transformer Co. Oakland, Calif.
97464 Industrial Retaining Ring Co. Irvington, N.J.
97539 Automatic and Precision Mfg. Co. Yonkers, N.Y.
97966 CBS Electronics Div. of C.B.S., Inc. Danvers, Mass.
97979 Reon Resistor Corp. Yonkers, N.Y.
98141 Axel Brothers, Inc. Jamaica, N.Y.
98159 Rubber Teck, Inc. Gardena, Calif.
98278 Microdot, Inc. So. Pasadena, Calif.
98291 Sealectro Corp. Mamaroneck, N.Y.
98405 Carad Corp. Redwood City, Calif.
98731 General Mills Minneapolis, Minn.
98821 North Hills Electric Co. Mineola, N.Y.
98925 Clevite Transistor Prod. Div. of Clevite Corp. Waltham, Mass.
98978 International Electronic Research Corp. Burbank, Calif.
99109 Columbia Technical Corp. New York, N.Y.
99313 Varian Associates Palo Alto, Calif.
99515 Marshall Industries, Electron Products Division Pasadena, Calif.
99707 Control Switch Division, Controls Co. of America El Segundo, Calif.
99800 Delevan Electronics Corp. East Aurora, N.Y.
99848 Wilco Corporation Indianapolis, Ind.
99934 Renbrandt, Inc. Boston, Mass.
99942 Hoffman Semiconductor Div. of Hoffman Electronics Corp. Evanston, Ill.
99957 Technology Instrument Corp. of Calif. Newbury Park, Calif.

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